On the observation of XPEEM image for insulator with E-field variable objective lens

Hideki Yoshikawa[1], Hideyuki Yasufuku[2], Masahiro Kimura[3], Sei Fukushima[4], Keiji Tamura[5] and Ryuichi Shimizu[5]

[1]Harima office, National Institute for Materials Science, SPring-8, Mikazuki, Hyogo 679-5198, Japan
[2]RICOH Co.,LTD., 16-1 Shinei, Tsuzuki, Yokohama, Kanagawa, 24-0035,Japan
[3]SPring-8 Service Co., SPring-8, Mikazuki, Hyogo 679-5198, Japan
[4]National Institute for Materials Science, 1-2-1 Sengen, Tsukuba, Ibaraki 305-0047 Japan,
[5]Osaka Institute of Technology, 1-79-1 Kitayama, Hirakata, Osaka 573-0196, Japan

X-ray photoemission electron microscope (XPEEM), which projects photoelectron's image with a cathode-lens-type objective lens, makes it possible to obtain high resolution (tens of nanometer) images. The cathode-lens-type objective lens applies very high electric field (about 10kV/mm) on a sample to realize small aberration coefficient. However, this high electric field penetrates deep into the insulating sample, increase the charging on the sample, and affects the XPEEM image. We have developed a XPEEM system at SPring-8 BL15XU, of which objective lens was newly designed to vary the electric field on the sample, in order to evaluate and reduce the penetrating electric field into the sample and the charging on the sample. In this work, we demonstrate how to observe insulating samples well with XPEEM. We observed the low-energy-electron's image excited SR for the multilayer PZT film shown in the figure. The vertical lines in both side of the cross-sectional image are Pd electrodes and other region is PZT. Low energy electrons were filtered by the energy analyzer. These XPEEM contrasts led to evaluate the inner potential pattern in PZT quantitatively. We have clarified that this inner potential came not from the penetrating electric field but from the stable charging.